1. Antheræa Roylei *Moore*. 2. Anth. Helferi *Moore*.

W. West imp.

1 Antheræa Frithi *Moore* 2 Saturnia Grotei *Moore* 3 Attacus Guerini *Moore*

G. H. Ford

W. West imp

on the shores of the Northern Pacific. Besides the present example, specimens are in the British Museum from the same country. Prof. Baird, in his 'General Report' (p. 698), seems hardly satisfied on this point.

27. Macrorhamphus griseus (Gm.).

28. Gambetta melanoleuca (Gm.).

29. Tringa wilsoni, Nutt.; Baird, Rep. p. 721.

30. Tringa ——?

31. Querquedula cyanoptera (Vieill.).

32. Querquedula carolinensis (Gm.) ♀.

33. Mergus cucullatus (Linn.).

34. Larus belcheri, Vigors, Zool. Journ. iv. 358.—*Larus heermanni*, Cassin?

35. Brachyrhamphus marmoratus (Gm.); Baird, Rep. p. 915.

An adult and two younger specimens.

Synopsis of the known Asiatic species of Silk-producing Moths, with descriptions of some New Species from India. By Frederic Moore, Assist. Museum, India House.

(Annulosa, Pls. LXIV., LXV.)

In the following list we have endeavoured to give descriptions of those species of silk-producing Moths that are known to inhabit India, its adjacent countries and islands, and to bring together such information (so far as our present materials will allow) relating to each individual species, as may prove interesting, and, we trust, useful, not only to the Oriental entomologist, but also to those gentlemen, in India and elsewhere, who devote their attention to the advancement of the productive resources of the silk trade.

Genus Bombyx, Schrank.

Bombyx, Schrank, Fauna Boica, ii. pt. 2. p. 150 (1802).
Phalæna-Bombyx, pt., Linnæus.
Bombyx, pt., Fabricius.
Sericaria, pt., Latreille.

1. Bombyx mori (Linnæus).

Phalæna-Bombyx mori, Linnæus, S. N. i. 2. p. 817(1767); Amœn. Acad. iv. p. 563; Faun. Suec. p. 832; (Aldrovand, Ins. p. 280; Albin, Ins. pl. 12. f. 16; Réaum. Ins. ii. pl. 5. f. 2; Roësel, Ins. iii. pl. 7, 8).

Bombyx mori, Fabricius, Spec. Ins. ii. p. 180; Mant. Ins. ii. p. 114; Ent. Syst. iii. i. p. 431; Godart, Lép. de France, iv. p. 153. pl. 14. f. 3, 4; Helfer, Journ. Asiatic Soc. Beng. vi. p. 40; Walker, List Lep. Het. Brit. Mus. pt. 6. p. 1505; Royle, Report on the Paris Universal Exhib. pt. 3. p. 216; Moore, Catal. Lep. Mus. India House, ii. p. 374.

Sericaria mori, Blanchard, Gay, Hist. de Chile, Zool. vii. p. 55.

The Common Domestic, or Chinese Silkworm Moth.

Pat of Benyal, Royle.

Hab. China (domesticated in China, Siam, India, Persia, France, Italy, &c.).

In a 'Dissertation on the Silk Manufacture and the Cultivation of the Mulberry,' translated from the Chinese works of Tseu-kwang-k'he, called also Paul Siu, a Colao, or Minister of State in China, and recently published at Shanghæ, and reprinted in 1858 at Madras, it is stated, that "the earliest allusion to the mulberry and silk met with in the ancient writings of the Chinese is in the Historical Classic, a work which existed before the days of Confucius, because it is quoted by him, and which embraces the history of China from B.C. 2356 to B.C. 722, a period of 1634 years. In the former part of that period, we have the allusions referred to, recorded in the section called the tribute of Yû, who flourished 2200 years before Christ. In his days the mulberry is spoken of as a well-known production, and silk as obtained therefrom; so that it must have been discovered before his days. The usual tradition is, that it was discovered during the reign of Hwângté (B.C. 2640) by his queen." The passages in the Historical Classic in which references to the mulberry and silk are made are as follows:—In giving an account of Yen-chow, the south-western part of the modern Shan-tung, the writer says, "The mulberry region having been supplied with silkworms, the people descended from the hills, and dwelt in the plains." On this the commentator remarks:—"The nature of the silkworm is to abhor dampness; hence it was not till the waters were abated that the silkworms could be reared. The nine regions of China equally depended upon this source of wealth; but the Yen province alone is mentioned, because it was best adapted for the mulberry." The Classic goes on to say that the tribute of Yen-chow consisted in varnish and silk, while their tribute-baskets were filled with wove stuffs of various colours (see translation of the Shoo-king, pp. 91, 92). In speaking of the production of Tsing-chow, the north-eastern part of Shan-tung, the Classic says that "from the valley of the Taé mountain they brought silk and hemp; while their tribute-baskets were stored with the wild mulberry and silk." The silk produced from the mountain mulberry is said by the commentator to be so tenacious, that it was peculiarly adapted for harps and guitars (see translation of the Shoo-king, p. 93).

Black silk and chequered sarcenets are spoken of as the production of Tseu-chow, the southern part of Shan-tung and the northern part of Këang-soo (see translation of the Shoo-king, p. 96).

The productions of King-chow, the modern Hoôk-wang, where silk

has since been cultivated to a great extent, are spoken of as consisting of black and red silks, with silk fringes (see translation of the Shooking, p. 101).

The next Classic in which we find any reference to the silkworm is the Chow-le, or Account of the Ceremonies of the Chow dynasty, where it is said that "the officer who adjusted the price of horses forbad the people to rear a second breed of silkworms in one season," because, in accordance with the views of astrologers, the horse belonged to the same constellation with the silkworms, and they were therefore considered of the same origin. Conceiving that two things of like nature could not prosper at the same time, the Chinese forbad the rearing of the second breed of silkworms, lest it should be of some disadvantage to the horses. However absurd this notion, it shows, at the least, that the rearing of silkworms was a common practice at that period.

After this we meet with frequent references to this subject in the Le-ke Book of Ceremonies. This book was written partly in the Tsin dynasty (B.C. 204) and partly in the Han dynasty (B.C. 135), and gives an account of the ceremonies observed by the Chinese in very early antiquity. In the 6th section of this work, entitled Yueling, we meet with the following directions :—

"In the first month of spring, orders were issued to the forester not to cut down the mulberry-trees; and when the cooing doves were observed fluttering with their wings, and the crested jays alighting upon the mulberry-trees, people were to prepare the trays and frames, &c., for the purpose of rearing the silkworms.

"In the spring season, when the empress and her ladies had fasted, they proceeded to the east, and personally engaged in picking the mulberry leaves; on this occasion the married and single ladies were forbidden to wear their ornaments, and the usual employments of females were lessened, in order to encourage attention to the silkworms. When the rearing of the silkworms was completed, the cocoons were divided (for reeling), and the silk weighed (for weaving), each person being rewarded according to her labour, in order to provide dresses for the celestial and ancestorial sacrifices: in all this none dared indulge in indolence."

From another passage of the same section we learn that in "the last month of summer the order was given to the female officers to dye the silk of various colours, in order to weave chequered sarcenets, comprising black and white, black and green, green and red, with red and white checks! All which was to be done according to the ancient rule, without the least variation; the black, yellow, azure, and red tints were all to be correct and good, without the least fault; in order to provide dresses for the celestial and ancestorial sacrifices, and standards for distinguishing the high and low degrees."

In the 24th section of the same book, on sacrificial rites, we read, that "in ancient times the emperor and his princes had a public mulberry-garden, and a silkworm establishment, erected near some river. On the morning of the first day of the third month of spring, the sovereign, wearing a leather cap and a plain garment, ascertained

by lot the chief of his three queens, with the most honourable amongst his concubines, and caused them to attend to the rearing of the silkworms in the above-named establishment. They then brought the eggs of the worms and washed them in the river above alluded to, after which they picked the mulberry leaves in the public garden, and aired and dried them, in order to feed the worms.

"When the season was over, the royal concubines, having completed the business of rearing the silkworms, brought the cocoons to show them to the prince, when he presented the cocoons again to his consort; whereupon his consort said, 'This is the material of which your highness's robes are to be formed.' Having said which, she covered herself with her robe, and received the cocoons. On this occasion the ladies of the court were honoured with the present of a sheep. This was the mode in which the presentation of the cocoons was anciently conducted."

Hawae-nan-tsze in the Silkworm Classic, says, that "Se-ling-she, the principal queen of Hwang-te (B.C. 2640), was the first to rear silkworms; and the Hwang-te was induced to invent robes and garments from this circumstance. Afterwards, when Yu regulated the waters (B.C. 2200), mention is made in his work on the tribute, of the land adapted for the mulberry-tree having been supplied with 'silkworms,' from which time the advantage thereof gradually increased. In the Yue-ling section of the Le-ke, it is said that in the last month of spring, the trays and frames, with the square and round baskets, were to be got in readiness for the rearing of the worms, &c. It appears, on examination, that the queens and wives of the nobles, through successive generations, personally attended to the rearing of the silkworms; how much more, then, ought the wives of the common people to busy themselves in the same! All this alludes to what was done in the Chow dynasty, B.C. 1000. It is recorded of Wán-te, of the former Hàn dynasty (B.C. 150), that he commanded his empress personally to attend to the picking of the mulberry leaves in order to prepare the sacrificial garments. King-té (B.C. 130) enjoined the same thing on his queen, that she might be an example to the empire. In the time of Yuên-té (B.C. 20) the empress-dowager Wang visited the silkworm establishment, leading on the empress and the different ladies of the court, to gather mulberry-leaves. In the time of Ming-té (A.D. 70) the empress with the ladies of the princes attended to the rearing of the silkworms. During the Wei dynasty, in the reign of Wân-té (A.D. 250), the empress attended to the silkworms at the northern border, according to the regulations of the Chow dynasty. During the Tsin dynasty, in the reign of Woó-té (A.D. 280), the silkworm palace was built, and the empress personally attended to the business of rearing the silkworms, as had been the practice during the two preceding dynasties. During the Súng dynasty, in the reign of Heaóu-woó (A.D. 460), the silkworm monastery was built, and the empress personally gathered the mulberry-leaves, as had been the practice in the preceding dynasty.

"In the northern Tsê dynasty (A.D. 490) a silkworm palace was

erected, and the empress went in person to gather the mulberry-leaves. According to the regulations of the Sûy dynasty (A.D. 620), the empress went to the appointed place to gather the mulberry-leaves. During the Tâng dynasty, in the reign of Chin-kwan (A.D. 650), the empress did the same; in the first year of the following monarch Hëèn-k'hing (A.D. 655), and in the reign of Këen-yuen (A.D. 747), the empresses all attended to the silkworm ceremony. At the same time a decree was issued, requiring that the silkworms should be fed in the palace, when the empress went in person to inspect them. During the Súng dynasty, in the reign of K'hae-paòu (A.D. 960), on recording the ceremonies performed at the celestial sacrifice, the prayer is given which was offered when the empress went in person to rear the silkworms. From all which we perceive that the empresses through successive dynasties attended in person to the business of rearing the silkworms. By selecting these extracts from the historical documents, we have set this matter in a very clear light, and placed the whole at the head of our treatise."

The Essay from which the preceding extract has been made contains many other interesting details, showing the importance attached in the earlier periods of Chinese history to the manufacture of silk generally, and especially to the cultivation of the mulberry in its various modifications.

"The culture of the mulberry silkworm" (*Bombyx mori*), remarks Dr. Royle *, "was early introduced into India from China, where it flourishes chiefly about Nankin, or in 32° of north latitude; but in India none of the old silk filatures extend to beyond 26° of north latitude. This can, I conceive, be ascribed only to the excessive heat and dryness of the north-western provinces of India being unsuitable to the animal, besides producing a dryer and harder leaf than it likes for its food."

The Rev. W. Fox, Curate of West Malling, Kent †, records the fact of *Bombyx mori* having been found in a wild state in England, and gives the following remarks:—

"On the 10th July 1858, a number of silkworms, estimated at from 80 to 100, were found under a hedge in a place called Banksfield, near West Malling, not far from Maidstone, Kent. There was no appearance of the insects having been scattered accidentally in the place, but, on the contrary, every indication of their having been hatched and sustained for some time in the spot where they were discovered. The leaves of several plants in the immediate vicinity were much eaten, showing plainly that the larvæ had for some time been feeding upon them. A bush of the common Bramble (*Rubus fruticosus*), among others, had been partially despoiled of its leaves. When discovered, about three-fourths of the whole number had spun their cocoons, which were hanging in all directions upon the weeds and the bramble referred to. Some were just commencing the spinning process, while others were yet in the larva state, and were feeding

* Report on the Paris Universal Exhibition, pt. 2. p. 216.

† See 'Athenæum' for October 16th, 1858.

quietly or roving about in quest of suitable places in which to construct their silken cells. Both the silk cocoons and the remaining larvæ were subjected to a close examination by the aid of a microscope, and were compared with other silkworms and cocoons, which had been bred or formed under the shelter of a house, but no perceptible difference of species could be discovered."

2. Bombyx religiosa (Helfer).

Bombyx religiosa, Helfer, Journ. Asiatic Soc. Bengal, vi. p. 41. pl. 6 (1837); Walker, List Lep. Het. Brit. Mus. pt. vi. p. 1506.

The Deo-mooga Silkworm, Hugon, J. A. S. Beng. vi. pp. 32–41.

The Joree Silkworm, Helfer.

Hab. Assam (*Capt. Jenkins*); Cachar (*Hugon*).

Remark.—Upon examination of typical specimens of *B. huttoni*, and comparing them with the description of Dr. Helfer's *B. religiosa*, I am rather inclined to believe them to be one species.

"The Deo-Mooga," says Mr. Thomas Hugon*, "I accidentally became acquainted with, and it is very little known to the natives, and entirely in the wild state. Three years ago, being employed in Jumna-Múkh (Cachar), I had occasion to take some bearings, for which puopose I had a white cloth put up on a large Bur-tree (*Ficus indica*); the year after, being near the same spot, the ryots came and told me that two months after I left (April) they observed that the tree had lost all its foliage; they went to it and found in the surrounding grass and dry leaves a large number of small cocoons; these they spun like the *Eria* out of curiosity, and used it with the latter. They took no further notice of succeeding breeds, finding the thing of little present use. I lost a few cocoons which I procured at the time, but have lately seen both the worm and the cocoon. The former is quite different from any other; it is more active, its length is under $2\frac{1}{2}$ inches, the body very slender in proportion to its length, the colour reddish and glazed. I could not observe them more particularly, as they were brought to me one evening at dusk: I put them in a box with the intention of examining them the next morning, but they disappeared in the night, although the box was open very little to admit the air. The moth is very much like that of the mulberry; so is the cocoon also in appearance, colour, and size. I have questioned many natives about this worm, but none had ever seen it before."

Capt. F. Jenkins discovered this species in Assam, which "is (says Dr. Helfer) very interesting, as it yields a silk, if not superior, yet certainly equal, to that of *B. mori*. The cocoon shows the finest filament, and has very much silky lustre. It is exceedingly smooth to the touch, and very different from the cocoon of the mulberry moth. The worm lives upon the Pipul-tree (*Ficus religiosa*). Its general introduction would be very easy, as the Pipul-tree grows abundantly over all India."

* J. A. S. Beng. vi. p. 32 (1837).

3. Bombyx huttoni (Westwood).

Bombyx Huttoni, Westwood, Cabinet, Orient. Ent. p. 26. pl. 12. f. 4 (1847); Walker, List Lep. Het. Brit. Mus. pt. 6. p. 1506; Moore, Catal. Lep. Mus. India House, ii. p. 379.

Hab. Mussooree (*Hutton*).

"This species," says Capt. Hutton, "is an inhabitant of these hills (Mussooree), occurring abundantly from the Doon upwards to at least 7000 feet; and the caterpillar, like that of *B. mori*, feeds on the leaves of the wild mulberry which grows here in our forests. Unlike the larva of *B. mori*, however, the present species has the caterpillar covered with long spines, although in colouring and shape there is great similarity between the two. The cocoon is spun in the leaf, which is drawn round it, and the silk is very fine and of a very pale yellow tint. I discovered this species on the 7th May 1842, on some mulberry trees growing at an elevation of about 6500 feet above the sea, with a southern aspect. Some of the caterpillars were of a large size, and nearly full-grown at this time, whilst others were in all their intermediate stages of growth. The caterpillar is of a pale yellowish cream-colour, mottled or marbled down the back and sides with a mixture of grey, yellow, and rufous or brownish lines; the anterior segments of the body are mottled above with livid grey, and ornamented with four blackish oblong spots or ocelli placed obliquely; along the back are two rows of long black spines curving backwards, and on the anal segment is one long spine in the middle; the two anterior pair of spines spring from the ocelli, and the last pair are curved forwards, instead of backwards, like the rest; there is also on each side a row of short spines springing from the base of the true legs. The anterior segments swell up into a hump like those of the larva of *B. mori*. As the caterpillar becomes mature, the rufous colouring fades away and gives place to a mottling of pale livid grey; the head is also mottled. It grows to about $2\frac{1}{2}$ inches in length, and spins in the leaf early in May. They are double brooded, for mine all hatched in June, and deposited their eggs, a few of which produced caterpillars that year, but the greater number remained until the following spring." —*Westwood's 'Cabinet of Oriental Entomology.'*

Capt. Hutton, in reply to some inquiries by J. Bashford, Esq., relating to this species, states* that "*Bombyx huttoni* cannot be treated like the domestic kinds, but must (at least for the present) be reared *upon the trees*. The worms will not remain in the trays, nor even upon twigs placed in water, when once the freshness of the leaf is gone. On the tree it is perfectly free from restlessness, and saves a vast expense in feeding, besides possessing the advantage of always having perfectly fresh food at command, —an essential point in forming good silk, as the quality of this substance must always be greatly influenced by the healthy secretions of the animals producing it.

* Journ. Agri-Horticult. Soc. India, ix. p. 391 (1857).

"Cocoons of *B. huttoni*, produced in the house from worms placed upon small branches set in jars of water to keep them fresh, are always inferior to those produced upon the trees, and I doubt not you would find this to be the case with the domestic species in Bengal."

The Agri-Horticultural Society of India has lately reported most favourably on the silk of this species, which has been brought into notice by Capt. Hutton. The worm spins in all weathers, whereas the common silkworm, *B. mori*, is apt to be thrown off work by a passing cloud. It is thought that this new silkworm may prove commercially important, and Government is solicited to institute experiments regarding its productive powers (*vide* 'Madras Journal,' March 1857, p. 268).

4. Bombyx horsfieldi (Moore).

Bombyx horsfieldi, Moore, Catal. Lep. Mus. India House, ii. p. 380. pl. 11 *a*. fig. 5 (1858).

Hab. Java. In Museum, India House.

This species, of which a female only was collected in Java by Dr. Horsfield, is of a brownish-grey colour. The fore-wings have two transverse, slightly curved, brown bands, the first one-third from the base, the other one-third from the apex, the latter having undulated margins; between the two bands is a grey-centred brown discal spot; a brown streak immediately below the apex, its inner margin being pale. The hind-wing is pale ferruginous at the base, and has a narrow curved pale submarginal line, the veins being also pale; and on the abdominal margin are two blackish-brown spots, one being near its base, the other about its middle. Expanse $2\frac{3}{4}$ inches.

5. Bombyx subnotata, Walker.

Bombyx subnotata, Walker, Journ. Proc. Linn. Soc. Lond. iii. Zool. p. 188 (1859).

"Male. Ferruginous, thick, pilose. Fore-wings rounded at the tips, extremely oblique along the exterior border, which is slightly angular in the middle and slightly excavated on each side; underside with a yellow costal spot near the tip. Hind-wings with the interior border densely fringed towards the tip. Antennæ broadly pectinated. Mouth obsolete. Abdomen much more slender than the thorax, not extending beyond the hind-wings; anal lateral appendages fringed. Legs short, stout. Expanse of the wings 16 lines; length of the body 7 lines."

Hab. Singapore.

This species was collected by Mr. A. R. Wallace.

6. Bombyx lugubris (Drury), Exot. Ins. iii. p. 28. pl. 21. f. 5 (1773).

Described as inhabiting Madras; requires further confirmation before we can say that it belongs to the genus *Bombyx* (as now re-

stricted). To us it appears like a species belonging to a genus of *Drepanulidæ* *.

Genus Cricula, Walker.

Cricula, Walker, List Lep. Het. B.M. pt. 5. p. 1186 (1855).
Euphranor, Herr.-Schäffer, Lep. Exot. Spec. Nov. p. 61 (1858).

Antennæ in male deeply bipectinated, in female minutely so. Palpi pilose, very short. Proboscis short, distinct. Legs stout, pilose; tarsi short, thick; hind tibiæ with two minute apical spurs. Abdomen short, thick. Wings broad; fore-wing in the male slightly convex along the costa, falcate at the tip, concave along the exterior margin, inner angle rounded; hind-wing shorter, rounded at the angles. Female with the tip of fore-wing less falcate, and the exterior margin nearly straight.

1. Cricula trifenestrata (Helfer).

Saturnia trifenestrata, Helfer, Journ. As. Soc. Beng. vi. p. 45 (1837); Herr.-Schäffer, Lep. Exot. Spec. Nov. ser. 1. pl. 17. f. 80 ♀.
Cricula trifenestrata, Walker, List Lep. Het. B.M. pt. 5. pp. 1187, 1196; Moore, Catal. Lep. Mus. India House, ii. p. 384.
Euphranor trifenestrata, Herr.-Schäffer, Lep. Exot. Spec. Nov. p. 61 (1858).
♂ *Saturnia zuleika*, Westwood, Cabinet Orient. Ent. p. 25. pl. 11. f. 1 (1847).
Antheræa zuleika, Walker, List Lep. Het. B.M. pt. 5. p. 1252.

* "Silk is entirely a gum or glutinous substance," says Mr. F. Bashford. "I have extracted it from many hundred worms in every stage. It is deposited in both sides of the worm in two cylindrical shapes, doubled into three layers or folds, thick in the middle, and tapering at both ends, but much more so at the latter end, which accounts for the end of the cocoon giving a thread of a finer and lighter colour. The gum, if instantly taken from the worm, may be pressed and moulded into various shapes, and is very elastic: but very slight exposure gives strength to it, and fixes the thread in the ratio of the cylinders, large in the centre and tapering at the ends. If you expose it to a hot sun, the softer and colouring gummy matter becomes brittle, and may be broken off or separated, leaving the fixed gum in the shape of a thick white thread, strong (if not too much exposed to the sun), and slightly elastic. At the time of spinning, the two cylinders unite in one aperture, and the gummy matter is exuded by the worm in one continued thread; the more sticky nature of the soluble portion fixes the thread to the twigs at first, and ultimately to each other in the formation of the cocoon; the motion of the head of the worm causes it to be drawn out from the cylinders; the peculiar nature of the worm's secretion and the motion of the head enables it to elongate the silky gum, as it is drawn from the body in a soft state, into a thread of considerable length; exposure immediately hardens and fixes it, but it can only be done by the aid of the outer stick (? sticky) and more soluble gum. The two gums, or animal secretions, differ most materially: the one must be boiled out with a solution of alkali, before the other will take a perfect dye; but this solution does not injure the fixed gum or silk thread; a more powerful chemical is necessary to render that soluble; it *is* soluble, and art may make old silk dresses available some day for weaving and converting into a new fabric, as our Yorkshire friends now do with old woollen cloth rags."—(Extracted from the 'Journal of the Agricultural and Horticultural Society of India,' 1857, ix. p. 269.)

? *Phalæna-attacus fenestrata*, Linnæus, Syst. Nat. i. pt. 11. p. 811 (1767); Mus. Lud. Ulr. 372; Clerck, Icon. pl. 55. f. 1.

? *Phalæna-attacus perspicua*, Linnæus, S. N. i. 11. p. 811.

Var. ♀. *Euphranor multifenestrata*, Herr.-Schäffer, Lep. Exot. Spec. Nov. f. 551. p. 61 (1858).

Hab. N.E. and S. India, Silhet, Assam, Burmah, Java.

The larva, chrysalis, and cocoon of *C. trifenestrata* are figured in the 'Catal. of Lepidoptera' in the Museum, India House, vol. ii. pl. 27. figs. 7, 7 *a*, 7 *b*, copied from the original drawings made under Dr. Horsfield's superintendence in Java. The larva (according to Dr. Horsfield) "feeds on the Teng-gulung (*Protium javanum*), the Kettos (*Canarium commune*), and the Ingas (*Mangifera ingas*?). Abundant during December and January; scarce in March."

The cocoon is of a beautiful yellow colour, and of a rich silky lustre, and constructed like network, the enclosed chrysalis being visible.

Discovered in Assam by Capt. Jenkins, "where it lives on the *Soon* teee, but seems to be not much used" (J. A. S. Beng. 1837, p. 46); and at Moulmein by Capt. J. C. Haughton, who states that he "only observed it upon the Cashew-nut tree (*Anacardium orientale*), which, though exotic, has thoroughly taken root both at Tavoy and at Moulmein, and is now to be found in every native garden (Journ. of the Agri-Horticultural Soc. of India, 1858, p. 101)."

Gen. nov. Salassa, Moore.

Antheræa (Group III. pt.), Walker, List Lep. Het. B.M. pt. 5. p. 1250.

Antennæ deeply bipectinated. Abdomen short, rather thick. Wings broad; fore-wings *without ocelli*; fore-wing with costal margin convex towards the tip, where the angle is falcated; posterior angle round, inner margin somewhat straight; hind-wings *with ocelli*; the apex round, the anal angle less so.

Remark.—This genus, of which only one species is as yet known, may be distinguished from *Antheræa* by the absence of the ocellus in the fore-wing,—all the known species of *Antheræa* possessing a distinct but varying ocellus in *both* the fore and hind wings, whereas in *Salassa* it is replaced by a small diamond-shaped vitreous spot.

1. Salassa lola (Westw.).

Saturnia lola, Westwood, Cabinet Orient. Ent. p. 25. pl. 12. f. 3 (1847).

Antheræa lola, Walker, List Lep. Het. Brit. Mus. pt. 5. p. 1252.

Wings rich brownish-red; fore-wing with an obscure transverse line near the base, a small diamond-shaped vitreous discal spot, followed by a transverse dark dentated line, beyond which is a greyish-brown fascia bordered on each side by a dark dentated line, and terminated at the apex in a grey patch; hind-wing paler at the base, with a black-centred ocellus, which is encircled by a white and then

by a red ring; around this runs a broad incomplete circular line, extending from above the ocellus and terminating on the abdominal margin; an exterior submarginal dark dentated line.

Expanse $4\frac{1}{2}$ inches.

Hab. Silhet.

Genus Antheræa, Hübner.

Antheræa, Hübner, Verz. bek. Schmett. p. 152 (1816).
Antheræa (part), Walker, List Lep. Het. B.M. pt. 5 (1855).
Phalæna-attacus, pt., Linnæus.

Antennæ broadly bipectinated in male, less so in female. Proboscis invisible or obsolete. Abdomen stout, very thick in female. Wings ample, each with a rounded ocellus, whose disc is partly or wholly vitreous, and is traversed by the discal veinlet; fore-wing convex along the costa; tip falcated in the male, more rounded in the female.

1. Antheræa paphia (Linnæus).

Phalæna-attacus paphia, Linnæus, S. N. i. 2. p. 809 (1767); Mus. Lud. Ulr. p. 369; Cramer, Pap. Exot. ii. pp. 78, 81, 82. pl. 146. f. *a* ♀, pl. 147. f. *a*, *b* ♀, pl. 148. f. *a* ♂.

Bombyx paphia, Fabricius, Syst. Ent. p. 557; Spec. Ins. ii. p. 168; Mant. Ins. ii. p. 108; Ent. Syst. iii. 1. p. 409; Sykes, Trans. Asiatic Soc. London, iii. p. 541 (with a plate).

Phalæna paphia, Roxburgh, Trans. Linn. Soc. vii. p. 33 (1804).

Antheræa paphia, Hübner, Verz. bek. Schmett. p. 152 (1816); Moore, Catal. Lep. Mus. Ind. House, ii. p. 385.

Saturnia paphia, Helfer, Journ. As. Soc. Beng. vi. p. 42 (1837).

Phalæna-attacus mylitta, Drury, Ill. Exot. Ins. ii. p. 8. pl. 5. f. 1, App. p. (1773).

Bombyx mylitta, Fabricius, Syst. Ent. p. 558.

Attacus mylitta, Blanchard, in Jacquemont's Voy. dans l'Inde, Zool. Ins. p. 24. pl. 3.

Antheræa mylitta, Hübner, Verz. bek. Schmett. p. 152; Walker, List Lep. Het. B.M. pt. 5. p. 1247.

Saturnia mylitta, Westwood, edit. Drury's Ins. ii. p. 10. pl. 5. f. 1; Royle, Reports on the Paris Universal Exhibit. pt. 3. p. 216; Guérin-Meneville, Rev. et Mag. Zool. (1855), p. 297. pl. 6. f. 2.

Tesser; *Folliculus et Eruca bengalensis*, vocatur *Tesser*, Rumphius, Herb. Amb. iii. p. 115 (1750).

Tusseh Silkworm Moth, Hind., Helfer.

Bughy Silkworm Moth of the Burbhoom Hills, Roxburgh.

Kolisurra Silkworm Moth of the Mahrattas, Col. Sykes.

Munga Silkworm Moth of the Meches, B. H. Hodgson.

Kontkuri Mooga of the Assamese, Hugon*.

Hab. Difficult to determine; but specimens have been received from N.E. India, Silhet, Assam, S. India, Ceylon, and Java.

The transformations of the Tusseh Silkworm Moth are figured in

* J. A. S. Beng. vi. p. 32.

vol. ii. Catal. Lep. Mus. Ind. House, on plate 29, fig. 1, 1 *a*, copied from the original drawings made by Lady Isabella Rose Gilbert.

Also figured among the drawings of the late Gen. Hardwicke.

One of the earliest notices of an insect, very nearly allied to this species, is given by the venerable Rumphius in his 'Herbarium Amboinense,' vol. iii. p. 113. pl. 75 (1750), who discovered the larva in Amboyna feeding on the *Mangium caseolare rubrum* (*Rhizophora caseolaris*, Linn.). The figures of the larva, cocoon, and imago, on Rumphius's plate, show its close affinity to the *Anth. paphia*.

Dr. Roxburgh states this to be the "*Bughy* of the natives of the Burbhoom Hills, where the silk, which the same people call *Tusseh*, is manufactured. It is a native of Bengal, Bahar, Assam, &c. Feeds upon the leaves of *Rhamnus jujuba* (Byer of the Hindoos) and of *Terminalia alata glabra*, Roxb. (Asseen of the Hindoos)."

They are found in such abundance, over many parts of Bengal and the adjoining provinces, as to have afforded to the natives, from time immemorial, an abundant supply of a most durable, coarse, dark-coloured silk, commonly called Tusseh-silk, which is woven into a kind of cloth called Tusseh-doot'hies, much worn by Brahmins and other sects of Hindoos.

Eggs white, which hatch in from two to four weeks. The larvæ acquire their full size, which is about 4 inches in length, and 3 in circumference, in about six weeks. When the larvæ approach their full size, they are too heavy to crawl in search of their food with the back up, as is usual with most caterpillars, but traverse the branch suspended by the feet. When the larvæ are ready to spin the cocoon, each of them connects, by means of the recent glutinous filament of which the cocoon is made, two or three leaves into an exterior envelope, which serves as a basis to spin the complete cocoon in; besides, the cocoon is suspended from a branch of the tree by a thick, strong, consolidated cord. The cocoon is of an exact oval shape, and exceedingly firm texture. The chrysalis remains dormant for about nine months, viz. from October until July, the perfect insect always emerging during the night; and does not exist more than from six to twelve days when confined.

Michael Atkinson, Esq., says, "This species cannot be domesticated. I am informed that the natives cannot even retain any of it for seed. The hill people say that they go into the jungles, and under the Byer and Asseen trees they find the excrement of the insect; on which they examine the tree, and, on discovering the small worms, they cut off branches of the tree sufficient for their purpose, with the young brood upon them; these they carry to convenient situations near their houses, and distribute the branches on the Asseen tree in proportion to the size thereof, but they put none on the Byer tree. The Parieahs, or hill people, guard the insects night and day while in the worm state, to preserve them from crows and other birds by day, and from bats by night."—Dr. Roxburgh, Trans. Linn. Soc. vii. p. 33 (1804).

According to Col. Sykes, this is the "Kolísurra silk-worm of the Deccan. It feeds indiscriminately on the Sagwan or Teak-tree

(*Tectona grandis*), the Bor (*Zizyphus jujuba*), the Asana (*Terminalia alata glabra*), and the Mulberry Tut (*Morus indica*). The cocoons are extensively used by matchlock-men, cut into thongs, as ligatures for binding the matchlock barrel to the stock : the thongs are more durable than those of leather."

From the Journal of the Agricultural and Horticultural Society of India, 1848 (vi. p. 167, *et seq.*), we extract the following notes by Messrs. B. H. Hodgson and R. W. G. Frith. According to Mr. Hodgson, "this is the *Munga* silkworm moth of the Meches, and is found wild in the Saul forest. It feeds on the Saul tree (*Shorea robusta*) ; the fibre yielded is very strong, and must surely be that known to classic commerce, and used by the Romans for the manufacture of the awnings of their immense theatres." Mr. Frith says :—

"As far as my acquaintance with this insect extends, I believe it to be found throughout the whole of this side of India ; that is to say, from the north-western range of the Himalaya direct south as far as Midnapore, and also through the north-eastern range to Assam and southwards to Chittagong. I have no doubt but that it extends further, but cannot state so from my own experience. Dr. Royle, in his volume on the productive resources of India, states that it was found by Colonel Sykes in the Bombay, and by Dr. Geddes in the Madras Presidency. I have seen it from Mussooree, and have it in my own collection from Kussowlee, Darjeeling, Assam, Cherra Poonjee, Sylhet, Chittagong, from Chota Nagpore, and from several of the districts of Bengal. In Bengal I have taken the larva at all seasons of the year, except during the cold weather, when the trees constituting its food are useless. It is most abundant, I am informed, in the Bhangulpore district, where the cocoons in their proper season are collected by cart-loads for the manufacture of the *Bhaugulpore* or *Tusseh silk*, as it is called, and now so well known. It is not on account of the great size of the larva that it is obliged to take to the under side of the twigs to enable it to traverse them in search of food (as is [above] stated by Dr. Roxburgh), for it can pass along the twigs in any position when they are strong and thick enough for its powerfully clenching feet to find sufficient to grip hold of. It is clear that when the larva approaches the ends of the thinner branches and twigs (which it frequently does, having taken it on some so slight that it has been in a perfectly pendent position), it would be impossible for it to travel with ease to itself in such a position as to keep itself *upwards* ; it therefore prefers to take the *under* side of the twig, and passes along it in a suspended position, with the aid of its powerful feet,—for it takes some little trouble to make them release their hold when once firmly fixed.

"I have known the perfect insect make its appearance out of the cocoon in the rainy season in about twenty days. A great deal depends, however, upon the temperature and the state of the atmosphere as to the number of days that are required ere the moth makes its exit from the pupa state. The food of the larva seems to be confined to the leaves of but a few trees : I found it only upon

the Bair (*Zizyphus jujuba*), both wild and cultivated kinds, and on the Badaam or country almond (*Terminalia catappa*). Mr. Hugon (see Journ. Asiat. Soc. vi. p. 32) states that it feeds, in Assam, not only on the Moonga trees, but also on the former of those mentioned above, and on the Semal (*Bombax heptaphyllum*). Dr. Helfer describes it as being taken upon and from other trees, and these are transplanted on to the Assun tree (*Terminalia alata*), but that they feed most commonly in the wild state on the Bair and Semal trees. Mr. Hodgson again has discovered that its food is the Saul tree (*Shorea robusta*), since writing which I have been informed by a friend that in the Midnapore district the larva feeds upon the Saul tree also.

"Dr. Helfer (J. A. S. Beng. vi. p. 43) states that, 'according to Michael Atkinson of Jungypore, this species cannot be domesticated, because the moths take flight before the females are fecundated.' Dr. Helfer's opinion does not bear out the truth of this remark; and I agree with him, as he further states, in continuation, that, having kept them in a musquito curtain to prevent their escape, they were readily impregnated by the males, and deposited thousands of eggs. The moths no doubt, both male and female, will fly away if not confined in any manner to prevent them, particularly the males, for the sole purpose of seeking the females. I am of opinion that this silkworm might be reared and domesticated with very little care and attention. A female, for instance, produced from the cocoon, and retained captive, can, as above stated, be readily impregnated by the males, which are so eager for the intercourse, that I have at times taken as many as from ten to fifteen individuals in the course of a couple of hours, between the hours of two and four in the morning, and that for three or four times in succession, with the aid of the same decoy female. The moths, both male and female, live for about ten days, if they are not allowed to approach each other for the purpose of reproducing their species, and this without food of any kind, seeing that they are not provided by nature with a mouth.

"Mr. Hugon states that the natives consider there are two varieties of this species, the Bhugy and Jharoo. I do not think so; I believe them to be one and the same species. The larva sometimes, for instance, when feeding on the common Bair of the jungles, is of a very dark green colour, precisely that of the leaf itself, and might by some be considered as a different species, when compared with one that has fed on the Badaam (*Terminalia catappa*), which is of a much lighter and prettier green, with a degree of transparency at the same time, and a slight tinge of yellow pervading it. The fact of the perfect insect being devoid of any mouth has led me to infer that the secretion which it emits for the purpose of softening the substance of the very hard cocoon from which it has to make its escape is voided from the abdomen; and when effected, it has to *turn itself round in the cocoon* to enable it to set to work, with its two forefeet, which are provided with extremely strong and curved claws, and, thread by thread, works for itself an opening, through which,

while yet moist, its escape from the cocoon is effected, and that too before its wings have in any way enlarged by expansion to impede its exit. It is my intention to endeavour to ascertain this point beyond any doubt, if possible*."

Mr. Hodgson, again, says:—"With regard to the distribution of the species, I apprehend that Mr. Frith is mistaken in supposing it does or can occur in climates like that of Darjeeling; for I not only never heard of the species here, but have failed in an experiment to rear it, which was carefully conducted under favourable circumstances, from cocoons got in the Saul forest, by Mechis in my service, who are habituated to rearing silkworms. Gentlemen who make collections in this quarter are apt to blend whatever they procure from the Tarai forest, and lower hills, and from the mountains above them; and I conjecture that Mr. Frith's specimens of *Antheræa paphia*, said to come from Darjeeling and Cherra Poonjee, were really obtained in the lowlands beneath those places. I notice this point because of the numerous and important mistakes relative to the geographic distribution of zoological and botanical species which have thus been propagated. For example, Mr. Ogilby was led in this manner to suppose an Otine bird (*Eupodotis bengalensis*) an inhabitant of these vast and precipitous and heavily wooded mountains, and to name the species *Hamalayensis*, though it is really as little capable of dwelling in such a habitat as is, I apprehend, the *Anth. paphia*, or, more generally, any species of silkworm whatever. Silkworms abound south and east upon or near the level of the plains, but I doubt if they pass the limits of Bengal in a north-westerly direction, even upon the plains; and, so far as I know, the Cosi river is their limit in that direction; nor do I believe they are ever found, tame or wild, at elevations materially above the plain level in Bengal or in Hindostan. In the Saul forest they may pass up towards the north-west as far as that forest extends, or to Hurdwar. But the Saul forest is hardly elevated at all above the level of the adjacent plain; and Cherra at 4000 and Darjeeling at 7000 differ *toto cœlo* in characteristic productions, as in climate, from all places situated on the low open level of the Gangetic plains. The *Anth. paphia* avoids the open plain, as well as the mountainous heights;

* Captain Thomas Hutton, in the Journal of the Agri-Horticultural Society of India for 1856, p. 166, says, "*I doubt this*, because I have fully ascertained that the species known as *Actias selene*, which is furnished on the shoulder of each wing with a hard brown spine for the purpose of dividing the threads, likewise discharges a moistening liquid; and although, as in *Saturnia*" (i. e. *Antheræa*), "it is said to have *no mouth*, yet it is nevertheless *from the mouth*, or the place where it should be, that the solvent is discharged. The mouth is an *imperfect* mouth only, and is not organized for the reception of nourishment, although sufficiently perfect, it would appear, to secrete the liquid with which the threads are moistened. When the agglutinizing matter is thus dissolved, the threads are easily separated by the wing spines, and an opening afforded for the egress of the moth. I have this season watched this process in no fewer than 200 specimens of *Actias selene*, and can answer for there being no mistake about the matter, a drop of the clear colourless liquid often remaining upon the tuft of hair or down on the forehead between the eyes, and which tuft appears to be used as a brush for the application of the solvent to the threads of the cocoon."

and, as it seems to me, is exclusively confined to primitive forests on the level, or near it, of the plains. If, therefore, the species be found wild in Bhaugulpore, Sylhet, Chittagong, or even Choto Nagpore, it is, I apprehend, confined in all those districts to the uncultivated and forest tracts at the base of their respective hill ranges. Further inquiry as to the food of the wild worm of the Saul forest confirms my prior information, that this species feeds almost, if not quite exclusively, on the leaves of *Shorea robusta*: and, as that tree extends not westerly beyond Hurdwar, the habitat of Kussowlee appears to me dubious, unless there be some mistake about the species.

"The above remarks," continues Mr. Hodgson, "may seem tiresome: but those who are aware of the stress now laid on the geographic distribution of species, and of the numerous errors of fact that have crept into the subject, as relates to this quarter, from the source above adverted to, will probably deem otherwise. My attention was drawn to the subject of the distribution of silkworms in India, with reference to the notices which the classics have left us of the ancient trade of India with the west, in the Roman times particularly."

To the above Mr. Frith replies:—"Regarding the geographical distribution of the species, I am almost at a loss how to satisfy Mr. Hodgson as to the circumstance of its being found at Darjeeling, having received it from thence myself, from a party collecting for me. Again, those from Cherra Poonjee were collected by persons on the spot who are employed by me for the sole purpose of forming entomological collections."

Again, Mr. Hodgson writes:—"The wide diffusion of silkworms throughout the continent of India in the plains seems clear, and is a very interesting circumstance with reference to what we find in the classics about the trade of India with Europe in the latter days of Rome and thereafter. Mr. Taylor (Journal Asiatic Society of Bengal) supposed that the chief 'things in commerce' in those days were products of Assam only. But I had long before traced most of them as indigenous products of all India extra Gangem, from Suddiah to Hurdwar, leaving silk only as an apparent exception. It need be no longer; fine wild worms of various kinds being, it now appears, found north-west all the way to the *débouche* of the Ganges into the plains. So far, then, I agree with Mr. Frith. But I confess myself still quite a sceptic as to the alleged fact of the silkworms tenanting these mountains at elevations like that of Darjeeling."

In answer to the above remarks by Messrs. Hodgson and Frith, we quote the following by Captain Thomas Hutton:—

"The Tusseh Moth (*Saturnia paphia*), which Mr. Frith says he has procured from Mussooree and Kussowlee,—a statement doubted by Mr. Hodgson, who confines the insect to the plains and base of the hills, pointing out that collectors are in the habit of jumbling species from various localities into the same box, and calling them a collection of Himalayan species—

"Mr. Frith afterwards appeals to my letter to Mr. Westwood as

showing, as he imagines, from the mention of *Sat. paphia*, that I had procured it at Mussooree. This is rather a bold jump to a conclusion!

"In reply to this part of the discussion, I incline to the side of Mr. Hodgson, whose remarks regarding the mode adopted by collectors of specimens in general, no matter whether birds or insects, are most correct. The practice here at Mussooree is this:—a person wishing to make a collection either takes a native collector into service, or purchases the specimens singly from independent collectors who hawk about insects for sale. These native gentry, whether hired or otherwise, not being over-fond of hard work, invariably *go down from Mussooree into the Doon at the foot of the mountains*, and having there filled their boxes, return to the hills to sell them.

"The collector, in most cases disdaining to know the difference between a moth and a butterfly, stows them all away into his boxes. These collections are then sent off, or carried off, as illustrative of the entomology of Mussooree and Landour, to which the collection bears about as close an affinity as the fauna of Southern India does to that of the Northern Provinces,—species common to both being intermingled with others that exclusively belong to the one locality or the other. Thus the greater portion of species in these collections is exclusively lowland.

"Now among the lowlanders I am inclined to include the Tusseh Moth! I have collected at Simla and its neighbourhood, as well as at Mussooree; but during my long residence at the latter station, I have only once in fifteen years seen the Tusseh Moth; and that one specimen was a female captured *in the Dehra Doon near Hurdwur*; besides that, I am not altogether certain that the species is identical with the true Bengal Tusseh. In fact I doubt the occurrence of that species in the hills, whether at Mussooree or at Kussowlee.

"Thus far the statements of Mr. Hodgson are, I think, correct; but when he proceeds to assert that the Saul tree (*Shorea robusta*) does not extend westward of Hurdwar, he falls into an error that any traveller may correct, since there are splendid forests of Saul throughout the Dehra Doon, and even away as far west as the Jumna, if not farther.

"The Tusseh Moths to which I alluded in my letter to Mr. Westwood were all sent to me in cocoon from Bhagulpore by the late Capt. Don. We have here at Mussooree, and also at Simla, a species of *Saturnia* [*Antheræa*] feeding on the common Hill Oak (*Quercus incana*), and bearing a resemblance to the Tusseh Moth, though much smaller, and quite distinct: can this be Mr. Frith's Kussowlee species?

"Mr. Frith mentions having 'inspected a very fine collection made by a gentleman at Mussooree, in which are no less than eleven species of true *Bombycidæ*, viz. nine of the genus *Saturnia*, one of *Actias*, and one of *Saturnia* [*Antheræa*] *mylitta*, or the true Tusseh Moth.' Now if this collection belonged to a son of the late Col. Buckley *, I can easily clear up the mystery of the Tusseh Moth coming from

* This collection was presented to the East India Company's Museum in 1849.

Mussooree, since it was *one of my Bhagulpore specimens* given in exchange for something else: and I may as well point out that the collection to which I allude contained species from various parts of India, I myself having contributed insects from Mirzapore, Neemuch, and even from Afghanistan in exchanges, while there were also a few from China! Besides which, Mr. Buckley's object being to make a collection without noting or caring for locality, the greater number of his specimens came, as usual, from the Dehra Doon. This (if I am right in my conjecture about the collection alluded to by Mr. Frith) may serve to show with what degree of suspicion any collection, *not made by a naturalist*, should be regarded by scientific men both at home and abroad, since, by taking it for granted that the collection contained only the species proper to the locality in which it is stated to have been made, the closet naturalist may be led to form the most erroneous conclusion in regard to the distribution of species. Nor is this remark to be confined to insects only, since it will equally apply to ornithological collections; so that any modern Adam who may underteke to form a system, founded rather *upon the length and breadth of an animal's tail* than upon the habits and manners of the species in their native haunts, and who thunders forth his dogmas from his artificial paradise of musty skins, may, and doubtless often has, put forth a host of errors for the acceptance of other *naturals* as little conversant with living species as himself!

"My own limited experience, therefore, leads me to coincide in opinion with Mr. Hodgson, and I accordingly reject the Tusseh Moth from the catalogue of Mussooree and mountain species, not even granting it a place at Kussowlee.

"Of true mountaineers, we have, as far as my knowledge extends, three species of *Saturniæ*; two others are found only in the depths of the warmest valleys, such as *S. atlas*? and *S. katinka* (Westw.); the former occurring likewise in the Doon along with the Tusseh Moth; thus making in all six species of *Saturniæ*."

In a foot-note Capt. Hutton further remarks:—"In my enumeration of the species found here, I omitted one large *Saturnia*, which I once found upon a quince tree in the Botanical Garden; the larva when first seen appeared to be a white cocoon on the back of a leaf, but a closer view showed me the caterpillar densely covered with long white hairs. I never procured a second specimen.

"To these we may add one species of *Actias*, which is, I believe, confined to the hills from 5000 feet upwards to 7000 feet, and perhaps higher; it occurs likewise apparently in Sylhet, as Major Jenkins long ago kindly sent me a drawing of what I take to be this species. And lastly we have one species of true *Bombyx* (*B. huttoni*, Westw.), which occurs abundantly on the wild mulberry from the Doon upwards to at least 7000 feet; thus showing a list of known silk-spinners to the number of nine, viz. seven *Saturnia*, one *Actias*, and one *Bombyx*: more there may doubtless be, although as yet unknown to me, but I strongly suspect that some of those mentioned by Mr. Frith as coming from Mussooree and Kussowlee were in reality natives of other localities.

"Mr. Hodgson likewise notices the occurrence of what he and Mr. Frith pronounce to be the Arrindy Moth (*S. cynthia*); and I have it also from the Mussooree, where the caterpillar feeds on the shrub Mussooree (*Coriaria nipalensis*), and from which this station derives its name. Dr. Roxburgh's figure of the caterpillar of *S. cynthia* is, however, so thoroughly unlike those occurring here, that, notwithstanding the identity (if I may so speak) of the imago, I am unwilling to pronounce decisively as to the species until I have compared our larvæ with those of undoubted *S. cynthia* from Bengal. Ours occurs from the foot of the hills up to 6000 feet of elevation."

Lady Isabella Rose Gilbert figures the transformations of *Anth. paphia*, and in her MS. Notes says:—"Tusseh Moths are hatched twice in the year, in May and August: the larvæ go into the chrysalis state in September, remaining so till the May following; whilst those that enter the chrysalis state in July come out in three weeks. Many of the females lay eggs in eight or ten hours after quitting the chrysalis; others again do not till the following night, or longer. In ten days the young larvæ make their appearance, and feed on the Assun tree and the Sál sakooa (*Shorea robusta*). In about three weeks from the time of their exclusion from the egg, they attain their full size, and in eight or ten days more prepare for their transformation into the chrysalis. The caterpillar commences its operations by drawing a few leaves slightly together, as if to screen it from observation. It then spins a strong cord, composed of many threads, altogether about the thickness of a crow-quill, at the end of which it weaves the cocoon. The cocoon is so transparent for the first six and thirty hours, that the larva may be distinctly perceived at work in the interior; after that time the cocoon gradually acquires consistence by the continued industry of the caterpillar, and becomes quite opaque from the addition of a glutinous liquid with which it moistens the whole. When that dries, the cocoon appears as if covered with white powder, and in the course of a couple of days becomes perfectly hard.

"The moth generally deposits its eggs within a few yards of the cocoon; these the villagers collect and keep in their houses till the young caterpillars come forth, when they are placed on the Assun trees in the jungles, the proprietors remaining to protect them from the birds, and to bring home the cocoons when perfect. The people who rear these silkworms are of the Sontal and Bhouree castes, and practise many superstitious ceremonies while tending them in the jungles."

2. Antheræa pernyi (Guérin).

Saturnia pernyi, Guérin-Méneville, Revue et Mag. de Zool. (1855) p. 297. pl. 6. f. 1.

Antheræa mylitta, var., Walker, List Lep. Het. Brit. Mus. pt. vi. p. 1378.

Hab. China (Guérin). In British Museum Collection.

M. Guérin-Méneville observes that *A. pernyi* may be distinguished from *A. paphia* by the form and texture of its cocoon. In his figures

the male of *A. pernyi* differs from the same sex of *A. mylitta* by its less falcate fore-wings, and by the exterior band, which is different in colour, more straight; *and in the hind-wings is contiguous to the ocellus.* It is well figured in the above work.

3. Antheræa frithi, Moore. (Annulosa, Pl. LXV. fig. 1.)

Antheræa Frithi, Moore, Catal. Lep. Mus. Ind. House, ii. p. 396 (1858).

Male. Yellowish-ferruginous, the disc suffused with patches of darker ferruginous; the exterior margin and about the base greyish-ferruginous. Fore-wing with the costal band grey; the submarginal dark line evenly undulated, and parallel with it and before the ocellus are two deeply undulated lines, the inner spaces between which are suffused with yellow; a large prominent apical patch and space within the cell yellow. Hind-wing with the submarginal line deeply undulated, with two parallel deeply undulated inner lines, the spaces between which are suffused with yellow, the inner line extending round the ocellus and joining the sub-basal line. Ocelli small, similar to those in *Anth. paphia*. Antennæ yellowish. Frontal band grey. Body yellowish-ferruginous.

Expanse of wings $5\frac{1}{8}$ inches.

Hab. Neighbourhood of Darjeeling. In Museum, India House, London.

4. Antheræa roylii, Moore. (Annulosa, Pl. LXIV. fig. 1.)

Antheræa Roylii, Moore, Catal. Lep. Mus. Ind. House, ii. p. 397 (1858).

Dull greenish-buff colour. Male.—Fore-wing with the costal band brownish-grey; the subbasal lines and the oblique submarginal line indistinct, greyish. Hind-wing with the submarginal line indistinct. Ocellus of both fore- and hind-wings ill-defined, greenish-buff colour within, but with the inner half suffused with vinaceous; vitreous spot minute, the narrow outer ring black on its exterior half and red on the inner half, with an inner yellow line on the former, and a white line on the latter. Female with the wings somewhat brighter coloured exteriorly; the submarginal line of both wings more distinct; ocelli more distinct. Frontal band brownish-grey. Antennæ brownish. Body buff-colour.

Expanse of wings of male $5\frac{3}{4}$, female $6\frac{1}{2}$ inches.

Hab. Neighbourhood of Darjeeling. In Museum, India House, London.

5. Antheræa jana (Cramer).

Phalæna-attacus jana, Cramer, Pap. Exot. iv. p. 220. pl. 396. f. A (1782).

Bombyx jana, Olivier, Enc. Méth. Ins. v. p. 28.

Antheræa jana, Hübner, Verz. bek. Schmett. p. 152; Walker, List Lep. Het. Brit. Mus. pt. 5. p. 1250.

Hab. Java (*Cramer*).

Remark.—As yet we have no example of this species in England, but its distinguishing character is its small size; the ocelli being nearly opake; and the hind-wing has, besides the usual submarginal line, two additional undulated wider lines proceeding from the abdominal margin, the first extending round the ocellus, and the other only to the ocellus.

Expanse of wings $4\frac{3}{8}$ inches.

6. Antheræa perrotteti, Guérin.

Bombyx perrottetii, Guérin-Méneville, Mag. de Zool. 1843, pl. 123.

Antheræa perrottetii, Walker, List Lep. Het. Brit. Mus. pt. 6. p. 1379.

Hab. Pondicherry (*Guérin*). *Non vidi.*

Deep yellow; base of costal margin of fore-wing grey, with indistinct darker submarginal line; ocelli small, round, red, the exterior ring black, the inner whitish, with a small medial yellow spot; thorax in front grey; abdomen deep yellow.

7. Antheræa simla (Westwood).

Saturnia simla, Westwood, Cabinet Orient. Ent. p. 41. pl. 20. f. 1 (1847).

Antheræa simla, Walker, List Lep. Het. B.M. pt. 5. p. 1249; Moore, Catal. Lep. Mus. Ind. House, ii. p. 399.

Hab. Simla (*Capt. Boys*); neighbourhood of Darjeeling. In Museum, India House, London, and British Museum.

"Fore-wings very pale fulvous-brown, thickly irrorated with red scales; the costa and an oblique fascia, before the middle of the wings, very much attenuated posteriorly, of a pale pinkish white; the basal portion of the wing reddish, terminated by a dark pink line; the pale fascia is succeeded by a very oblique streak of reddish-brown, which rests on the *anterior edge* of the ocellus, which is rather small and of a dusky colour, with a slender curved white line on its inner side; the succeeding space is thickly irrorated with red-brown scales, followed by two rather indistinct slender and much waved strigæ, which terminate at the apex of the wing in a white angulated mark and a small black patch; the outer margin of the wing is widely ashy-fulvous, followed by a narrow ashy-coloured edging; the hind-wings have the greater portion of a pink colour, traversed basally by a dark pink fascia, which is recurved towards the inner margin; the middle of the wing is occupied by a large black ocellus bearing a dull yellow circle with a slender white curved line, and a dark pink one at its base; between the ocellus and the exterior margin of the wing are two waved red-brown lines, beyond which the colour is of a fulvous red, with a dull pale greyish-buff edging."

Expanse of wings nearly 6 inches.

8. Antheræa helferi, Moore. (Annulosa, Pl. LXIV. fig. 2.)

Antheræa helferi, Moore, Catal. Lep. Mus. Ind. House, ii. p. 397 (1858).

Male. —Yellowish-ferruginous, with a vinaceous tinge basally. Fore-wing with the grey costal band; three dark ferruginous pink-margined lines: the first sub-basal, transverse, and curved: the second within and near the base of the cell, oblique: the third above and joining the ocellus; the ocellus without a vitreous spot, which is replaced by a short yellow-margined line; a double submarginal indistinct undulated line, its apical end with a blackish spot; an indistinct suffused inner line close to the ocellus; and a dark marginal line of undulated streaks. Hind-wing with a dark marginal lunulated line; two darker submarginal deeply undulated lines, the inner line extending round the ocellus to the sub-basal line; the ocellus with the black outer line terminating at its upper end in an oval spot, without a central vitreous spot, which is replaced by a narrow yellow line. Antennæ brown; frontal band grey; body yellowish-ferruginous.

Expanse of wings 6 inches.

Hab. Neighbourhood of Darjeeling. In Museum, India House, London.

Remark. — Somewhat allied to *A. simla*; but may be distinguished from that species by its more falcated fore-wings, and by the absence of the obliquely transverse dark band, which ascends from the middle of the posterior margin, touching the ocellus on its inner side, and extends to the costa before the apex. The ocelli are also different, those in *A. helferi* being of a pale colour within, while those in *A. simla* are quite black, and on the hind-wing are much larger.

9. Antheræa assama (Helfer).

Saturnia assamensis, Helfer, Journ. As. Soc. Beng. vi. p. 43 (1837).

Saturnia assama, Westwood, Cabinet Orient. Ent. p. 41. pl. 20. f. 2.

Antheræa assama, Walker, List Lep. Het. Brit. Mus. pt. 5. p. 1249; Moore, Catal. Lep. Ind. House, ii. p. 398.

Mooga or Moonga of the Assamese, Hugon, J. A. S. Beng. vi. pp. 26–32; Helfer.

Moonga, Royle, Report of Paris Exhib. pt. 3. p. 216.

Hab. Assam, Silhet, Ceylon. In British Museum Collection.

The larva and cocoon of the Moonga are figured by Mr. Hugon in the Journal of the Asiatic Society above referred to, and he states that "although the Mooga Moth can be reared in houses, it is fed and thrives best in the open air and on the trees. The trees which afford it food are known in Assam by the following names, viz. 1. Addakoory; 2. Champa (*Michelia*, sp. ?); 3. Soom; 4. Kontooloa; 5. Digluttee (*Tetranthera diglottica*, Hamilt.); 6. Pattee Shoonda (*Laurus obtusifolia*, Roxb.); 7. Sonhalloo (*Tetranthera macrophylla*, Roxb.). There are generally five broods of Moonga worms in the year."

10. Antheræa larissa (Westwood).

Saturnia larissa, Westwood, Cabinet Orient. Ent. p. 49. pl. 24. f. 1 (1847).

Antheræa larissa, Walker, List Lep. Het. B.M. pt. 5. p. 1250; Moore, Catal. Lep. Mus. Ind. House, ii. p. 398.

Hab. Java (*Dr. Horsfield*). In Museum, India House, London, and M. Dalen, Rotterdam.

Remark.—This beautiful species may be at once distinguished from all the preceding by the ocellus of the fore-wing, which has the exterior black line dentated towards the costa. It is also more falcated in the male. The figure referred to above is a good representation of the male.

Another species of *Antheræa* inhabits Mantchouria, as appears from the following:—

"It has long been known that in the land of the Mantchour Tartars, in a climate at least as rigorous as our own (*i. e.* England), a kind of silk is obtained, of which very large quantities go into consumption among the Chinese. This species is announced by M. Guérin-Méneville as having lately been reared in France.

"Some years since Mr. Rutherford Alcock, Her Majesty's Consul at Shanghae, sent home samples of this material, both manufactured and unmanufactured, along with live chrysalids (cocoons); but the latter perished on the voyage, and the samples were accidentally misplaced and lost in the Great Exhibition of 1851. The silk was strong, with little lustre, and resembled some strong thin yellow woollen linen. It now appears that the French have been more successful, some males having already been hatched. Of the other cocoons sent to Italy and Algiers, no account is given.

"According to Guérin-Méneville, this Silkworm forms a new species of *Saturnia*, and is nearly related to the *S. mylitta*, which produces the Tusseh silk of India. But the peculiarities observable in the form, texture, and mode of attachment of the cocoons forbid the Mantchour Moth being regarded as merely a northern local form of the Tusseh Silkworm. It is also one of the same group as the Moonga Silkworm of Assam (*Sat. assamensis*, Helfer).

"Two circumstances give peculiar interest to the introduction of this useful insect; namely the coldness of the country it naturally inhabits, and its feeding upon a species of oak, not on a mulberry. The country called Mantchouria is described as mountainous, very cold in winter, and producing *furs* among other articles of trade. Oaks, pines, willows, birches, maples, and wild roses, said to constitute the main feature of its woods, are all indications of a northern climate. The oak on which this silkworm feeds is not clearly described. According to M. Isidore St.-Hilaire, two sorts have been raised in France from the acorns received with the cocoons, one resembling the *Quercus castaneæfolia*, which is well known to be a native of Northern China, and one of a species apparently undescribed. But it is by no means improbable that the common oaks of this country would be taken to by the silkworms in question; and if so, the sole obstacle to the introduction of silk-growing among our rural population would be removed.

"It is right to add, upon the authority of Mons. St.-Hilaire, that the interesting acquisition is mainly owing to the assistance given by Mons. Verrolles, Bishop of Colomby, and Vicar-Apostolic in Mantchouria, to M. de Montigny, the French Consul at Shanghae." (From Journ. Agri.-Hort. Soc. India, 1856, ix. p. 63, and extracted from 'Gardener's Chronicle,' 30th June, 1855.)

Genus Loepa, Moore.

Antheræa (Groups II. and III., pt.), Walker, List Lep. Het. B.M. pt. 5. p. 1250.

Loepa, Moore, Catal. Lep. Mus. Ind. House, ii. p. 399 (1858).

Antennæ bipectinated. Palpi very short. Proboscis obsolete. Abdomen not very stout. Wings moderately long and broad, each with an ocellus, whose disc is thinly clothed with hairs; fore-wing convex towards the tip, which, in the male, is somewhat falcated; hind-wing with the angles rounded.

1. Loepa katinka (Westwood).

Saturnia katinka, Westwood, Cabinet Orient. Ent. p. 25. pl. 12. f. 2 (1847).

Antheræa katinka, Walker, List Lep. Het. B.M. pt. 5. p. 1251.

Loepa katinka, Moore, Catal. Lep. Mus. Ind. House, ii. p. 399.

Hab. Assam; Silhet; Java.

Yellow; costa of fore-wings grey. Each wing with a fulvous-brown ocellus, the middle of which is purplish, and has a curved white streak which is bordered by a slender black line; across the middle of the wing is an indistinct, waved and bidentated line, beyond which is a double blackish waved line terminating near the apex in a black demi-oval spot, followed by a fulvous apical patch containing two white lunules; near the exterior margin of the wings is a submarginal row of slender white lunules, and near the base of each wing is a slender rosy zigzag streak.

Expanse $2\frac{3}{4}$ to $3\frac{3}{4}$ inches.

The larva and cocoon of *Loepa katinka* are figured in Catal. Lep. Mus. India House, vol. ii., plate 20. fig. 1, copied from the original drawing made by Dr. Horsfield in Java, where the larva "feeds on the Galing (*Cissus*, sp. ——) and the Girang (*Leea*, sp. ——). Abundant during December, January and February."

2. Loepa thibeta (Westwood).

Saturnia thibeta, Westwood, P. Z. S. (1853) p. 166; Ann. Nat. Hist. 2nd ser. xv. p. 302 (1855).

Antheræa thibeta, Walker, List Lep. Het. Brit. Mus. pt. 5. p. 1250.

Fore-wings yellow, much varied with grey scales, especially at the base and beyond the middle; near the base is a transverse oblique slender red striga. In the middle of all the wings is a moderate-sized oval ocellus, with a black central dot, marked on its inner edge

with a curved white line, the outer part being liver-coloured, edged with a black ring. Outside the ocellus the wings bear a darker fulvous, ill-defined, very oblique fascia, followed by two slender very strongly undulating dark lines; the undulations being much stronger towards the tip of the wing, where the outer one is connected with a white curved line, like a U, which ends on the costa in an oval black patch, and is bounded on its outside by a slender rich red-brown line; parallel and near the apical margin is an interrupted slender black striga, followed by a row of submarginal oblong fulvous spots. The ocellus of the hind-wing is preceded by a curved dark brown line, and is followed by three slender very much undulated lines, the two next the ocellus being chestnut and the outer one black; beyond the last is a broad greyish fascia, edged outwardly with a slender interrupted black line, followed by a row of oblong sublunulated fulvous spots. Antennæ, body, and legs fulvous-yellow; front of thorax with a grey band.

Hab. Thibet (*Westwood*).

Genus Actias, Leach.

Actias, Leach, Zool. Misc. ii. p. 25 (1815); Macleay.
Tropæa, Hübner, Verz. bek. Schmett. p. 152 (1816).
Plectropteron, Hutton, Trans. Ent. Soc. Lond. v. p. 45 (1847).
Phalæna-attacus, pt., Linnæus.

1, Actias selene (Macleay).

Actias selene, Macleay, Leach's Zool. Misc. ii. p. 26. pl. 70 (1815); Hutton, P. Z. S. Lond. (1856) p. 5; Moore, Catal. Lep. Mus. Ind. House, ii. p. 400.
Tropæa selene, Hübner, Verz. bek. Schmett. p. 158; Walker, List Lep. Het. B.M. pt. 6. p. 1262.
Plectropteron selene, Hutton, Trans. Ent. Soc. Lond. v. p. 85.
Plectropteron dianæ, Hutton, Trans. Ent. Soc. Lond. v. p. 45 (1847); Ann. Nat. Hist. xvii. p. 60.
Phalæna attacus luna, Cramer, Pap. Exot. i. pl. 31. f. A, B (nec Drury).
Hab. N. India; Darjeeling; Masuri.

The larva of this curious species is figured by Capt. Hutton in the 'Transactions of the Entomological Society of London,' vol. v. pl. 5. He remarks, "A specimen of this splendid Moth was brought to me on the 13th April 1842, by a boy who had captured it in a deep and warmly sheltered glen at Mussooree. The specimen was a female, and was found clinging to the branches of a tree, or rather shrub, very similar to the Tartarian honeysuckle; it was accompanied by a male (*in coitu*), which effected its escape. As the specimen was much injured by her rough captor, I suffered her to live and deposit her eggs, which she did on the evening of the same day, to the number of thirty-two, each being of the size of a large mustard seed, and of a mottled brownish colour. During the whole of the succeeding day she remained perfectly stationary, but in the

evening deposited 84 eggs; and on the following evenings she again deposited as follows:—On the 15th, 38 eggs; on the 16th, 21; on the 17th, 16; on the 18th, 21; on the 19th, 14; on the 20th, 14; and on the 21st, 7; amounting in all to 246 eggs, and she then died.

"On the 28th April I received a male and female from the same place; and in the evening the female deposited 89 eggs, and continued each night to increase the number until she had deposited 300 eggs, when she died.

"On the 30th April, or eighteen days from the time of deposition, the first batch of eggs began to hatch; the newly born larva is about 3 lines in length, hairy, and of a pale rufous-red, with a single black band across the middle of the body, and a small black transverse mark on the anterior segment; along the back are two rows of small tubercles, and another along each side, from each of which spring a few short hairs, the base of which forms a small black dot; there is also an anal tubercle, larger than the others, and placed between the two last tubercles of the dorsal rows; the head is black. I was now exceedingly puzzled to find out the proper food, and, having unsuccessfully tried several kinds, at last gave them the leaves of our common hill oak (an Ilex), of which they ate sparingly and without appetite. This was evidently not the proper food; and although they continued to eat it they did not thrive, but died in such numbers, that I had at last only five larvæ left out of 546, and even these I was in daily expectation of losing; when, by a lucky chance, on the 30th of June, I discovered a single larva in the forest feeding on a tree known to the natives as the '*Munsooree*' (*Coriaria nipalensis*). Branches of this tree were now substituted for the oak, and from thenceforward the larvæ ate greedily and increased rapidly in size. The *first* moult commenced when six days old, and this occupied three days, so that at the end of nine days the larva appeared in its *second* stage. The black transverse band upon the body had disappeared, but the head still remained of that colour, and the rest of the body was hairy and rufous; the tubercles being black on the summit and more prominent; pro-legs brown.

"The period between each change was about ten days in some specimens, but varied in others between that and shorter periods.

"In the *third* stage the caterpillar appeared of a bright rufous colour, the black dots or tubercles being larger and more prominent, but there were no black bands. In the *fourth* stage the change was still more remarkable, for the caterpillar now appeared of a beautiful apple-green, each tubercle headed with bright orange, except the *four* which spring from the second and third segments, which are ringed with black, and crowned with pale yellow; and the *anal* and *two posterior* tubercles, which are green throughout. From each tubercle springs a small tuft of hair, the centre of each being longer than the others; the head and prolegs brown; along each side is a line which is red above and yellow below, and the spiracles are red; there is a line of very small yellow dots along each side, between the rows of tubercles. In the *fifth* stage the colours are the same, as

they are also in the *sixth* and *seventh* stages; but the caterpillar increases rapidly in size, and is most beautiful and delicate in appearance, with a semi-transparency of hue, which makes it look something like wax-work.

"One of these commenced spinning its cocoon on the 17th July, being then about forty-six or forty-seven days old, and the remainder after the interval of a day or two. The cocoon is formed of coarse brown silken threads, closely interwoven, and of an ovate form; it is inclosed among the leaves of the tree, which are in fact glued closely round it. It is hard, and not furnished interiorly with a soft silken bed, the chrysalis lying within a hard and hollow chamber. The chrysalis remained thus until the 14th August, when the one which had turned on the 17th July produced a perfect female, after a period of twenty-nine days. Another, which had turned on the 19th July, came forth a male on the 16th August, showing the time to be pretty uniform. A large caterpillar, however, which I found in the forest on the 16th July, turned to a chrysalis on the 24th of that month; but, instead of coming forth in the autumn, it remained in the chrysalis state throughout the winter, as did some others, coming out in the following summer, namely on the 11th, 14th, and 18th of June.

"The caterpillar feeds upon several trees common on these hills. The most common food appears to be the Munsooree, a shrub which is so common, as to have given rise, I believe, to the name of this settlement, viz. 'Munsoory,' or more commonly among Europeans 'Mussooree' (*Coriaria nipalensis*)."

"I have again reared specimens of *A. selene*, and observed attentively the method by which it *cuts* its way through the cocoon, by means of the instrument which I have named 'the wing spur' or 'spine.' Before proceeding to separate the threads of the cocoon by means of the wing spines, I have ascertained that the Moth ejects from *the mouth* a few drops of a clear colourless fluid, with which the gum is dissolved; and it appears to use the tuft of down on the front, between the eyes, as a brush for the application of the solvent." —P. Z. S. 1856, p. 5.

Capt. Hutton further remarks (Journal of the Agri-Horticultural Society of India, ix. p. 167–9 (1856), "I have this season (1855) watched the process of the escape of this Moth from the cocoon in no fewer than 200 specimens, and can answer for there being no mistake in the matter, a drop of the clear colourless liquid often remaining upon the tuft of hair or down on the forehead between the eyes, and which tuft appears to be used as a brush for the application of the solvent to the threads of the cocoon.

"I have this year (1855) reared a number of the caterpillars of *A. selene* for the purpose of ascertaining the value of the silk, but am sorry to say have failed in my attempts to unwind the silk from the cocoons. With some difficulty I managed to procure a supply of eggs from the moths, which came forth in October, and had intended sending them to Europe, when to my regret and surprise they began to hatch on the 4th of November, and are still coming forth

daily (10th). They are at present thriving on the shrub, *Coriaria nipalensis*, growing in the open air; but whether they will be able to spin up again before the frosts set in remains yet to be seen. These caterpillars feed naturally on *Coriaria nipalensis*, *Andromeda ovalifolia*, the walnut, and I think also upon *Carpinus bimana*. The first-named shrub would probably grow well and rapidly in some parts of Europe, and so furnish nourishment both for the larvæ of *Act. selene*, if found worth introducing, and also of *S. cynthia*, which seems to be acclimated in Italy.

"This species, I believe, is confined to the hills from 5000 feet upwards to 7000 feet, and perhaps higher; it occurs also in Silhet, as Major Jenkins kindly sent me a drawing of what I take to be this species."

The transformations of *Act. selene* were also observed by Lady Isabella Rose Gilbert, and are figured among her Ladyship's original drawings, from which those given in the Catal. Lep. Mus. India House (vol. ii. pl. 19.) were copied.

2. Actias mænas, Doubleday.

Actias mænas, Doubleday, Ann. Nat. Hist. 1847, p. 95; Westwood, Cabinet Orient. Ent. p. 45. pl. 22.

Tropæa mænas, Walker, List Lep. Het. Brit. Mus. pt. 6. p. 1263.

Hab. Silhet. In British Museum Collection.

This species differs from *A. selene* in the following characters:— "The wings are yellow; the thorax is wholly purplish in front; the wings are red along the exterior margin, and have no exterior band; the fore-wings have a band between the base and the ocellus, the ocellus being large and sickle-shaped, and very different from that of *A. selene*; and the hind-wings have longer tails."

3. Actias sinensis, Walker.

Tropæa sinensis, Walker, List Lep. Het. Brit. Mus. pt. 6. p. 1264 (1855).

Hab. North China. In British Museum Collection.

"Male.—Yellow. Wings with a slender, deeply undulating, tawny middle band; ocellus rose-coloured in the centre, luteous in front, with a brown border, which is much darker and broader in front than elsewhere. Fore-wings rose-coloured along the costa. Hind-wings ferruginous along the exterior border and across the tails, which are much shorter than the breadth of the wings. Thorax rose-colour in front. Expanse about 4 inches."

Genus Saturnia, Schrank.

Saturnia, Schrank, Faun. Boica, ii. pt. 11. f. 149 (1802).
Pavonia, Hübner, Verz. bek. Schmett. p. 157 (1816).
Phalæna-attacus, pt., Linnæus.

Types *Saturnia pyri*, *S. spini*, and *S. carpini* of Europe.

1. Saturnia pyretorum, Boisduval.

Saturnia pyretorum, Boisduval, Westwood, Cabinet Orient. Ent. p. 49. pl. 24. f. 2 (1847); Walker, List Lep. Het. B.M. pt. 5. p. 1273; Moore, Catal. Lep. Mus. Ind. House, ii. p. 404.

Hab. China. In Collection, India House; British Museum.

Milky-white; costal and frontal band white, each wing with a moderate-sized oval black ocellus, having a slender fulvous line surmounted by pale blue lunule, and with a curved vitreous central streak; beyond the middle of the wings are two strongly dentated slender dark lines, resting on a broad brownish submarginal band; a brown band also on the exterior margin, base of fore-wings, and a sub-basal band on both fore- and hind-wings, dark brown. Head, hind part of thorax, and large anal tuft dark brown.

Expanse 3 to $3\frac{3}{4}$ inches.

2. Saturnia grotei, Moore. (Annulosa, Pl. LXV. fig. 2.)

Saturnia grotei, Moore, Catal. Lep. Mus. Ind. House, ii. p. 404.

Fore-wing pale buff-colour, brownish along the costa and about the apex, and thickly irrorated with black and brown scales to beyond the middle; a large black-margined, maroon-coloured ocellus, containing a narrow transverse white lunule; a submarginal black band, bounded inwardly with a double zigzag pale margined black line, which extends to near the apex, where the space contains a maroon-coloured patch and a black spot, both of which are irrorated with white scales; exterior margin dull buff, with a row of narrow oval maroon-brown spots. Hind-wing brownish at the base and along the abdominal margin; the disc pink, containing a similar, but smaller ocellus, as the fore-wing; a submarginal black band, bounded inwardly by two undulated black lines, the inner line extending round the ocellus; exterior margin dull buff, with a row of narrow oval maroon-brown spots. Thorax crossed by a pale buff line.

Expanse nearly 3 inches.

Hab. Darjeeling. In Museum, India House, London.

Genus Attacus, Linnæus.

Phalæna-attacus, Linnæus, S. N. i. pt. 2. p. 808 (1767).
Attacus, Hübner, Verz. bek. Schmett. p. 155 (1816).
Hyolophora, pt., Duncan, Nat. Libr. vii.

1. Attacus atlas (Linnæus).

Phalæna-attacus atlas, Linnæus, S. N. i. pt. 2. p. 808 (1767); Mus. Lud. Ulr. p. 366; Cramer, Pap. Exot. iv. pp. 180, 183, pl. 381. f. C, pl. 382. f. A.

Bombyx atlas, Fabricius, Syst Ent. p. 566; Spec. Ins. ii. p. 167; Mant. Ins. ii. p. 108; Ent. Syst. iii. 1. p. 407; Olivier, Enc. Méth. Ins. v. p. 24. pl. 69. f. 1.

Attacus atlas, Hübner, Verz. bek. Schmett. p. 156; Walker, List

Lep. Het. B.M. pt. 5. p. 1218; Moore, Catal. Lep. Mus. Ind. House, ii. p. 405.

Var. *Phalæna-attacus atlas*, Cramer, Pap. Exot. i. p. 13. pl. 9. f. A.

Var. *Saturnia silhetica*, Helfer, Journ. Asiat. Soc. Beng. vi. p. 41 (1837).

Hab. China; N. & S. India; Ceylon; Burmah; Java.

The larva and cocoon of this (the largest of all known Lepidopterous insects) are figured on plate 20. of vol. ii. of the Catal. of Lep. Mus. India House, from the collection made by Dr. Horsfield in Java. "The larva feeds on the Molokka (*Phyllanthus emblica*), Kupu-gaja, &c., where it was abundant during December and January."

From the MS. Notes made by Lady Isabella Rose Gilbert in 1825, we extract the following:—"A specimen (female) of this magnificent moth was brought to me on the 4th September. On the following morning she laid several pink-and-white eggs. On the 15th the young caterpillars were hatched. Being uncertain what plant they fed on, I placed them upon slips of different trees, viz. apple, peach, plum, &c. The young caterpillars were black, with numerous white spines; as they grew larger and changed their skins, the spines became covered with a kind of white powder, giving them a very delicate appearance, added to which the ground colour of the body, since the first few days after they were hatched, had become a light green. They always ate their skins after casting them. Those on the apple tree grew to an enormous size, and on the 12th October one of them began to prepare for its transformation, by bending back a large leaf and enclosing itself in a web, which it completed on the 13th. On the 22nd June following the moth came out."

It is said that the Chinese Tusseh silk is obtained from the cocoon of this species.

2. Attacus edwardsi, White.

Attacus edwardsii, White, P.Z.S. (1859) p. 115. pl. 57; Moore, Catal. Lep. Mus. Ind. House, ii. p. 406.

Hab. Darjeeling. In Collection British Museum and India House.

This species is distinguished from *Attacus atlas* "by its intensely dark colour, especially on that band, bounded by angled and curved white, defined lines, in which the fenestræ occur. This band is of a dark blackish-brown, passing into a rich chestnut-brown above the fenestræ of the upper wings and on their posterior margin; the inner margin of the lower wings is of this red-brown also; the fenestræ are not bounded by a margin of black scales as in *Att. atlas*, but by ochreous-yellow squamulation; the part of the fenestra towards the base of the wings, which in *Att. atlas* is curved convexly, is in *Att. edwardsii* straight; the fenestra is longer, the white lines on the wings, breaking up the brown so beautifully, are wider, and that on the lower wing is less scalloped than in *Att. atlas*; the margin of the lower wing on the outside has two much-waved lines; the inner is yellow, with thirteen or fourteen undulations, continued on the

upper wing till it leaves off where the wing is dilated into the lobe, which gives the wing its hooked-like character; the lower line is brownish-black, and is straight, except in six places, where the black runs up the nerves triangularly to a point, and meets two of the yellow lobes, which are conjugate."

3. Attacus cynthia (Drury).

Phalæna-attacus cynthia, Drury, Exot. Ins. ii. pl. 6. f. 2; App. p. ii. (1773); Cramer, Pap. Exot. i. p. 62, pl. 39. f. A.

Phalæna cynthia, Roxburgh, Trans. Linn. Soc. vii. p. 42. pl. 3; Buchanan, Descr. Dinajpur, p. 214; Helfer, Journ. Asiat. Soc. Beng. vi. p. 45.

Bombyx cynthia, Olivier, Enc. Méth. Ins. v. p. 30.

Samia cynthia, Hübner, Verz. bek. Schmett. p. 156.

Saturnia cynthia, Westwood's ed. Drury's Ins. ii. p. 12, pl. 6. f. 2.

Attacus cynthia, Walker, List Lep. Het. B.M. pt. 5. p. 1220.

Saturnia arrundi, Royle, Reports on the Paris Universal Exhib. pt. 3. p. 216 (1856).

Arrindy or *Arrundi Silkworm Moth*, Roxburgh, Helfer.

Eria of Assam, Hugon, J. A. S. Beng. vi. p. 21.

Eri or *Eria of Assam*, Royle.

Hab. Specimens in Museum, India House, from China, Assam, N. E. India, Thibet, Java.

4. Attacus ricini (Boisduval).

? *Phalæna ricini*, Sir W. Jones.

Saturnia ricini, Boisduval, Ann. Soc. Entom. France, 3rd ser. ii. p. 755 (1854).

Attacus lunula, Walker, List Lep. Het. B.M. pt. 5. p. 1221 (1855).

Attacus ricini, Moore, Catal. Lep. Mus. Ind. House, ii. p. 407.

Hab. Specimens in the Museum, India House, from N. E. India, Assam; and others in the British Museum from Ceylon.

The specimens from Assam, under examination, are identical with those named *A. lunula* by Mr. Walker, and with others sent from Paris as *A. ricini*. Some of the references to the preceding species doubtless belong to this.

Domesticated in Malta, Piedmont, Tripoli, France, and in the Island of Granada.

The insect known to the Hindoos by the name of Arrindy in some parts, in others Arrundi, appears to be peculiar to the interior parts of Bengal; and, so far as I can learn, to two districts only, viz. Dinagepore and Rungpore, where the natives breed and rear it in a domestic state, as they do the common silkworm. The food of the caterpillar consists entirely of the common *Ricinus*, or *Palma Christi*, which the natives of these districts call Arrindy (hence the name of the insect), and is abundantly reared over every part of India, on account of the oil obtained from the seed.

The late Sir William Jones mentions this insect in a letter to Dr. Anderson, dated 17 May, 1791, under the name of *Phalæna ricini*:—

"Eggs pure white, which hatch in from ten to fifteen days. The larvæ arrive at their full size, which is from $2\frac{1}{2}$ to 3 inches, in about one month, during which they cast their skins three or four times. They are very voracious. The cocoon, or covering thereof, is white or yellowish, of a very soft, delicate texture; in general about 2 inches long and 3 in circumference, pointed at each end; the perfect insect comes out after a period of from ten to twenty days."

Mr. Atkinson remarks, that "they are reared in a domestic state, and entirely feed on the *Palma Christi* plant. The cocoons are remarkably soft and white, or yellowish; the filament so exceedingly delicate, as to render it impracticable to wind off the silk; it is therefore spun like cotton. The yarn, thus manufactured, is woven into a coarse kind of white cloth, of a seemingly loose texture, but of incredible durability, the life of one person being seldom sufficient to wear out a garment made of it."—(Dr. Roxburgh, Trans. Linn. Soc. vii. p. 42, 1804.)

According to Mr. Hugon, the caterpillar of the Eria (see Journ. A. S. Beng. vi. pp. 23, 24), in a domesticated state at Assam, "is, when young, about $\frac{1}{4}$ inch in length, and nearly black; as it increases in size it becomes of an orange colour, with six black spots on each of the segments; the head and legs are black; after the second moult they change to an orange colour; that of the body becomes lighter, in some approaching to white, in others to green, and the black spots gradually become the colour of the body; after the fourth and last moult, the colour is a dirty white or a dark green: the white caterpillars invariably spin red silk, the green ones white. On attaining its full size, the worm is about $3\frac{1}{2}$ inches long; its colours are uniform and dull; the breathing holes denoted by a black mark,—the moles have become the colour of the body, and have increased to long fleshy points, without the sharp prickles the Moonga worm has; the body has a few short hairs, hardly perceptible. In four days the cocoon is completed. The hill tribes settled in the plains are very fond of eating the chrysalis.

"The Arrindy, Arria, or Eria silkworm is reared over a great part of Hindostan, but more especially in the districts of Dinajpur and Ranjpur, in houses, in a domesticated state, and feeds chiefly on the leaves of *Ricinus communis*. The silk of this species has hitherto never been wound off, but people spun it like cotton. It is so productive as to give sometimes twelve broods of spun silk in the year. The worm grows rapidly, and offers no difficulty whatever for an extensive speculation." (Dr. Helfer, J. A. S. Beng. 1837, p. 45.)

In the Journal of the Agricultural and Horticultural Society of India (vol. ii. pt. 2. p. 61) is an accouut of the successful experiment of winding off the silk from the cocoon of the Eria worm. Some further accounts also appear in the Transactions of the Entomological Society of London for December 1854, and reprinted in the above Agricult. and Horticult. Soc. Journal, vol. ix. pt. 2. p. 29.

"One of the most active and distinguished of the members of the Society of Acclimation, M. Guérin-Méneville, who has been especially interested in the introduction of new silkworms, has recently succeeded

in acclimatizing in France a new silkworm from China, where it lives on the varnish-tree (*Ailanthus glandulosus*). The species is the true *B. cynthia* of Drury (1773), figured for the first time by Daubenton, jun., in his coloured plates, which were published between 1760 and 1765, and raised for some centuries in China, where its silk clothes the people. Roxburgh, in 1804, supposed the *Eria* which is raised in British India to be the same; and this confusion has continued till recently: so that the *Eria* (or 'Arrindy-arria,' as it is called in Hindostan) has gone by the name of *Saturnia cynthia*. The *Eria* is a different species, living on the *Ricinus*.

"The study of the species by Guérin-Méneville has brought to light differences between the two in the cocoons and the habits of the worms. The cocoons carded give an excellent flock of silk, which is used in China and Bengal for very firm tissues. The colour of the silk is a fine flax-grey; and clothes made of it are not injured by the rain, or oil, and wear long."—(From 'Silliman's Journal,' Nov. 1858; *vide* Ann. N. H. Jan. 1859.)

5. Attacus guerini, Moore. (Annulosa, Pl. LXV. fig. 3.)

Attacus guerini, Moore, Catal. Lep. Mus. Ind. House, ii. p. 409 (1858).

May be distinguished from *A. cynthia* and *A. ricini* by its smaller size and darker colour, the fore-wings having the two transverse white lines joined together about the middle, the junction forming a somewhat rounded spot; and by its being *without* the lunate vitreous streak, which is replaced by a small yellowish spot, which spot, in some specimens, is nearly obsolete. Hind-wing with a small rounded, yellowish, slightly vitreous spot.

Expanse from $3\frac{1}{2}$ to $3\frac{3}{4}$ inches.

Hab. Bengal. In Museum, India House.

The following remarks by M. Guérin-Méneville appeared in the Annals of Nat. Hist. June 1859, entitled "Fertile Hybrids of two species of *Saturniæ*":—

"Last year I succeeded in getting some females of *Bombyx cynthia* fecundated by males of *Bombyx arrindia* *, and *vice versâ*; and the eggs laid by them produced caterpillars. These caterpillars, reared last autumn, have shown nearly all the characters of *B. cynthia*, which is the wider and more vigorous of the two species. Their cocoons, although resembling a little those of *B. arrindia* by their deeper colour, conducted themselves in the same manner as those of *B. cynthia*; that is to say, being kept in a similar temperature, the moths did not come out in the winter, as those of *B. arrindia* constantly do. However, the influence of this latter species has been felt from this first generation; for, having placed some hybrid cocoons in the reptile-room of the Museum, where the temperature is never below 13° Centigrade, the moths came out at the end of March, whilst those of *B. cynthia* proper, which I had placed by their side for comparison, have not stirred yet. The moths pro-

* I am in doubt as to what species is here indicated.

duced by this hybridation show on the whole, as their caterpillars have done, more of the character of *B. cynthia* than of *B. arrindia*. They are larger; their abdomen is brown, with white tufts,—not white, as in *B. arrindia*; the band across their wings is edged with rosy atoms instead of whitish-grey, as in *B. arrindia*: however, they resemble this species inasmuch as their wings are of a browner and deeper colour than those of *B. cynthia*. The species which predominates physically is *B. cynthia*; but morally, so to speak, the influence of the other species has been more strongly felt; for the hybrids of the two categories give caterpillars which, although resembling those of *B. cynthia*, are less wild, or more domestic, which assimilates them to the caterpillars of *B. arrindia*. These hybrids take from *B. arrindia* the faculty of leaving their cocoons earlier, without, however, continually coming out during winter; and it is worthy of note that hybrids obtained from the female *B. cynthia* and male *B. arrindia* have come out a few days earlier than the opposite hybrids.

"I may add that the hybrids are polyphagous, as nearly all the *Bombyces* are; for they may be fed with teazel-leaves, as well as the ordinary silkworms, which have been fed at all times with lettuce, *Scorzonera*, goat's-beard, bind-weed, elm, rose-tree, and privet-leaves, &c."—(Comptes Rendus, April 11, 1859; Reprinted in 'Annals of Nat. Hist.' June 1859.)

In conclusion, I beg to add a few references where additional remarks on silk-producing moths, more interesting to the general reader, will be found, viz. in Journ. As. Soc. Beng. 1837, pp. 21, 38; Trans. Linn. Soc. London, vol. vii. p. 33; Journal of the Agri-Horticultural Society of India, vol. ii. pt. 2. p. 88; vol. ix. pt. 3. pp. 259, 391; Journ. As. Soc. Beng. xvi. p. 68; Proc. Entom. Soc. Lond. for Dec. 1854; Journal of the Society of Arts for Feb. 6th, 1857; the translation from the Chinese of the works of Tseu-kwang-k'he, Shanghae, 1849; and the Report on the Raw Products of Southern India in Madras Exhibition, 1858; Dr. Balfour's Cyclopædia of India; Noland's History of the British Empire in India, pp. 211, 403.

13. A General Review of the Genus Terebra, and a Description of New Species. By Mons. Deshayes.

Mr. Hinds, in 1844, published in the 'Thesaurus Conchyliorum' a very complete Monograph of the genus *Terebra*. When, ten years afterwards, we studied this beautiful group of Molluscs in the magnificent collection of Mr. Cuming, we did not suppose that the number of species would be considerably augmented; but the actual fact disabused us of this notion, for it was not without surprise we saw the number of species had nearly doubled itself.

Mr. Cuming proposed to put at our disposal all these valuable materials, if we would undertake to publish them; and we recognized